ably be a *vera causa* in the production of terrestrial climate, and must always *tend* to produce alternate mild and severe conditions, there must be some counteracting cause whereby these influences are weakened or neutralised. This modifying effect he assigns to changes in the distribution of land and sea, especially in high latitudes. He contends that without lofty land there can be no permanent snow and ice. Consequently by the due elevation of Arctic land an area would be provided on which, when winter occurred in *aphelion* during a period of high excentricity, there would be so copious an accumulation of snow and ice, that even during *perihelion* the wintry conditions would continue, and perhaps even in an intensified form. Subsidence of this land, however, would admit the warm oceanic currents from lower latitudes, and so great would be the amount of heat thereby transferred that even winter occurring when the North Pole was turned from the sun and the earth's orbit was at a maximum of excentricity would be insufficient to cover the Polar regions with an ice-cap. The alternate phases of precession, which tend to bring warmer and colder conditions of climate every 10,500 years, would introduce a complete climatal change only where the land was partially snow-clad. The general conclusion is thus reached that, the climates of the globe being mainly dependent on geographical conditions, their mutations in former periods have been chiefly brought about by changes in physical geography. Mr. Wallace supports these views by much ingenious reasoning. He argues that during by far the greater part of geological time the distribution of land has been such that warm oceanic currents have been able to pass freely to the North Pole, giving a mild climate to the whole northern hemisphere. He would thus account for the palæontological evidence of long-continued glacial conditions within the Arctic circle from Palæozoic to late Tertiary times. It was only in very recent times, he thinks, that the great northern continents became so completely consolidated as to shut out the tropical currents and to render possible the wide-spread and intense glaciation which was actually brought about by the high excentricity that occurred about 200,000 years ago. According to this view geographical revolutions "have been the chief, if not the exclusive, causes of the long-continued mild climates of the Arctic regions, while the concurrence of astronomical influences has been essential to the production of glacial epochs in the temperate zones, as well as of local glaciations in low latitudes."

In a remarkable chapter, remarkable as the deliberate judgment of an accomplished naturalist, the author decides that the vast periods of time which used to be demanded for the changes of geological history are not required even for the evolution of the floras and faunas of the earth. He admits, with some geologists who have advanced the same view from physical data, that geological changes probably occurred more vigorously and rapidly in former times than they do at present, and as these changes have always been accompanied by relative alterations in the forms of the organic world, he believes that organic evolution has taken place far more rapidly than has been hitherto thought possible.

ARCH. GEIKIE

ALGÆ

Species, Genera, et Ordines Algarum, seu descriptiones succinctæ specierum, generum, et ordinum, quibus Algarum regnum constituitur, auctore Jacobo Georgio Agardh, Bot. in Acad. Lund. Prof. Emer. Vol. iii. pars ii. 8vo. pp. 301. (Lipsiæ: apud T. O. Weigel, 1880.)

THE appearance of Dr. J. G. Agardh's excellent work, "Florideernes Morphologi," published in the *Acta* of the Royal Scientific Academy of Stockholm, was duly noticed in the pages of NATURE (vol. xxi. p. 282), but, as the work was written in Swedish, a knowledge of its contents was accessible to a limited number of students only; the indefatigable author has therefore, with a view to render it more useful to those who take an interest in his subject, now issued an edition in Latin of the Morphology.

This new volume, which is in 8vo, forms the second part of the third volume of Dr. Agardh's "Species, Genera, et Ordines Algarum," and may be considered rather as a revised edition of the Swedish work than as an exact translation of it. The author has made some alterations both in the text and in the notes. These alterations include important remarks on the most recent algological publications, including M. Bornet's "Notes Algologiques," M. Sirodot's observations on the fecundation of the Batrachospermeæ, and those of M. Dodel-Port on the fertilisation of the spores of Algæ by Vorticellæ.

For a summary of the contents of the new work the reader is referred to the before-mentioned notice in NATURE; it may however be remarked that the present volume forms a valuable addition to the "Species, Genera, et Ordines Algarum," to which it is now appended, and its appearance will undoubtedly be welcomed by all who take an interest in the morphology of Algæ.

In addition to a table of contents and an *index rerum*, there is also an index of the species referred to. The latter is the more useful, because, in addition to the name of the species, there are special references to the descriptions of the structure, ramification, reproductive organs, and other particulars relating to the plants. This arrangement is especially convenient, inasmuch as these matters are treated separately in different parts of the work.

It is to be regretted that the beautiful illustrations appended to the Swedish edition do not accompany the present. The figures are referred to in the latter, and may be consulted by those who are fortunate enough to possess a copy of the former, or who have access to libraries which contain copies of the *Acta* of the before-mentioned Swedish Academy. It may be added that Dr. Agardh's descriptions of the parts of the plants are expressed with his usual precision and clearness, and can, therefore, be understood without the plates—though, undoubtedly, better with them.

It may be observed that the present volume treats solely of the morphology of the Florideæ, and the author does not allude to the classification of Algæ, except to express his opinion that certain Algæ of red or purple colours, such as Bangiæ and Porphyræ, included by many algologists among the Florideæ, do not really belong to that class (p. 9, *note*). MM. Thuret and Le Jolis excluded these plants from the old class of chlorosperms, to which they were formerly considered to belong,

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Dr. Agardh does not admit them among the Florideæ; and in Dr. A. W. Bennett's new scheme for the classification of the lower cryptogams,[1] they seem to be literally nowhere. Neither has Dr. Bennett assigned any place in his scheme to the rather extensive family Valonieæ. It is to be hoped that algologists will agree before long on the position which these forms are finally to occupy in the classification of Algæ.

His work on the Florideæ having been thus brought to a successful termination, it is to be hoped that Dr. Agardh will now turn his attention to the Melanosperms, and that he will, before long, give us a new edition of the first volume of his "Species Algarum"; a work rendered necessary by an increased knowledge of the structure and fructification of these plants, and by the discovery and accurate examination of many new species. The ex-professor has already revised and reconstructed the extensive genera *Laminaria*, *Zonaria*, *Fucus*, *Cystophora*, and *Sargassum*—the latter as far as relates to the Australian species of the sections *Pterocaulon* and *Arthrophycus* only. To these must be added descriptions of many new species of Melanosperms, all of which have been published in the *Proceedings* of the Swedish Academies, and are, therefore, not within reach of many who would gladly consult them. A new edition, in which these scattered papers shall be collected and classified, would be a boon to algologists, and, we trust, would not entail very great labour upon the learned and industrious author.

M. P. M.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.]

"The New Cure for Smoke"

NATURE, vol. xxiii. p. 25, contains a letter from Dr. Siemens on a "new cure for smoke," and in that letter it is stated that, instead of using inert matter such as pumice-stone, he (Dr. Siemens) considers it far more economical and efficacious, in a gas-grate to transfer the heat of the gas-flames to gas-coke or anthracite, and that the result obtained shows that the "coke-gas fire" is not only warmer, but cheaper than its predecessor, the coal-fire, with the advantage in its favour that it is thoroughly smokeless.

Now having had considerable experience with gas-heating fires of various kinds, and being much interested in the success thereof, I determined to give the "gas-coke grate" a practical trial; and as the result of the trials which I have just completed, and which extended over a period of two months, may interest many of your readers, possibly you may be able to find space in your columns to record the following particulars:—

In the first set of trials a good modern fire-grate was arranged (as described by Dr. Siemens) with a solid iron dead-plate, and ½-inch gas-pipe, pierced with holes $\frac{1}{50}$th of an inch in diameter, placed in the front part of the grate, but behind the lowest bar, and all air excluded from below except that which was allowed to pass in between the hollow bottom and enter on the line of gas flames. The grate was then filled with coke broken into pieces about the size of a large walnut, the gas turned on and lighted. In a short time a good bright fire with a rich flame was obtained; the external temperature at starting was 32° F., and that of the room 45° F. This latter rose within two hours to 62° F., and was maintained as long as the fuel lasted, viz. fifteen hours, the gas and coke burning brightly the whole time.

The result of a number of these trials, with an expenditure of 28 lbs. of coke, was an average consumption of 325 cubic feet of gas, the expenditure of the latter being very accurately ascertained by passing the gas through a standard test meter.

A second set of trials was then made under conditions precisely similar to the above, with the exception that the gas was used only for lighting the coke at the commencement, and when a good fire was obtained, and the temperature had risen to 62° F., it was turned off, and only used again for a short time to reinvigorate the fire and maintain the temperature. This second series of trials—with an expenditure of 28 lbs. of coke—resulted in an average consumption of fifty cubic feet of gas; the fire, when the gas was turned off, was not so bright or rich as in the first series, and the fuel only lasted thirteen hours.

Upon the completion of the coke and gas trials as above, the grate was restored to its original condition for burning coal. The fire was lighted in the usual manner, and within two hours the temperature rose to 62° F. as in the previous trials, the external temperature at starting being 32° F., and that of the room 45° F., and with a consumption of 28 lbs. of coal 62° F. was maintained for fourteen hours.

The room in which the experiments were made was the same in each case, having a capacity of about 3000 cubic feet, a due north aspect, and situated about 150 yards from the river, to which it is entirely open.

The above facts having been ascertained after an extended and repeated series of trials, in which the fuel was most carefully weighed and the gas measured, it now becomes a simple matter to reduce the results to £ *s.* *d.*, and in doing so I have taken the present prices of gas, coke, and coal in this neighbourhood, which are as follows:—Coal, 26*s.* per ton; coke, 12*s.* per chaldron; and gas, 3*s.* 3*d.* per thousand cubic feet. From these we obtain the undermentioned results, viz.:—

First Trials. Coke and Gas continuously for fifteen hours

	d.
28 lbs. of coke at 12*s.* per chaldron	2·571
325 cubic feet of gas at 3*s.* 3*d.* per 1000 cubic feet	12·675
	15·246

Or 1·0164 pence per hour.

Second Trials. Coke, with Gas for lighting and use occasionally for assisting the Coke, for thirteen hours

	d.
28 lbs. of coke at 12*s.* per chaldron	2·571
50 cubic feet of gas at 3*s.* 3*d.* per 1000 cubic feet	1·950
	4·521

Or ·3477 of a penny per hour.

Third Trial. Coal only, for fourteen hours

	d.
28 lbs. of coal at 26*s.* per ton	3·9

Or ·2785 of a penny per hour.

It will, I think, be at once seen from the foregoing results that although by the use of gas and coke we get rid of the smoke nuisance, that desirable end is not obtained entirely without cost, and that, judging from these experiments, the "coke gas fire," while possessing many of the advantages claimed for it, has not proved in this instance to be warmer and cheaper than its predecessor the "coal fire."

Possibly some of your professional readers may find time to pursue the subject further and favour us with the result of their investigations. I have given a good deal of attention for years past to the employment of gaseous fuels, and have made many experiments, but I do not at the present time know of any fire-grate or stove (for ordinary household purposes) wherein gas is employed as the heating agent, either wholly or in part, which gives such good results as the raw material coal. At the same time there can be little doubt but that we shall yet discover the way to effect great economy in the use of fuel both for domestic and manufacturing purposes, and ultimately to solve the smoke nuisance question; but whether it will be by separating the raw material into its several constituents and bringing some of them together again under different conditions and proportions when being consumed in a gas furnace or grate, or by better and more perfect appliances for effectually burning the fuel in its raw state, has, I think, yet to be settled. The question however is one which concerns all alike, being a matter of both personal and national interest.

J. A. C. HAY

Royal Arsenal, Woolwich, January 29

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[1] See the Report in NATURE (vol. xxii. p. 451) of a paper read before the British Association at Swansea last year.

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